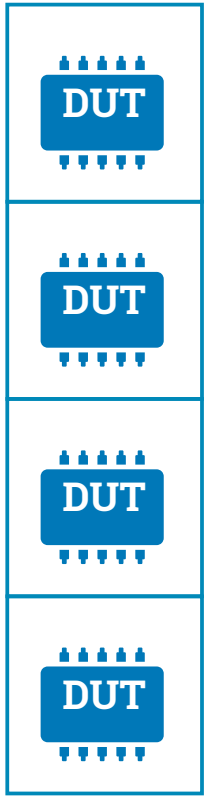
New Ways out of the Struggle of Testing Embedded Devices

Chris Fiege – c.fiege@pengutronix.de

Chris Fiege

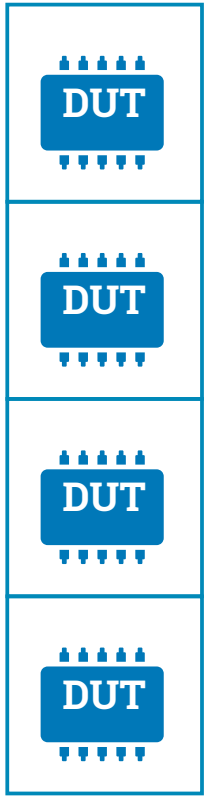
- Electrical Engineer
- Electronics Hardware Development
- At Pengutronix:
  - Supporting Software Developers with the hardware-part of their working environment

Pengutronix: Lab environment



Pengutronix: Lab environment

- Power Supply
- RS232
- Ethernet
- GPIO



Pengutronix: Lab environment

Power Supply

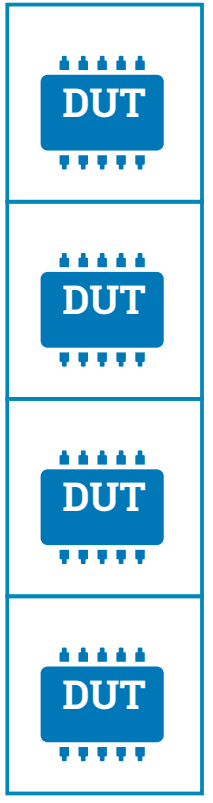
RS232

Ethernet

GPIO

Test-
Server

CAN



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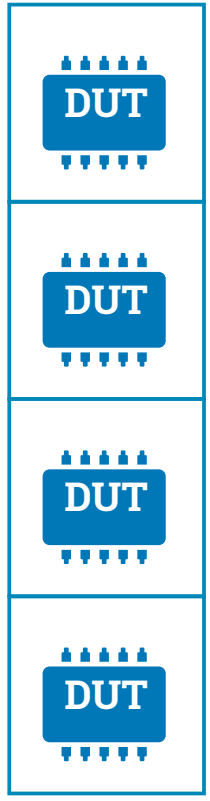

Pengutronix: Lab environment

- Power Supply
- RS232
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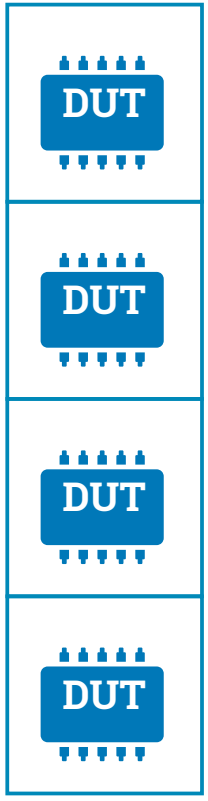
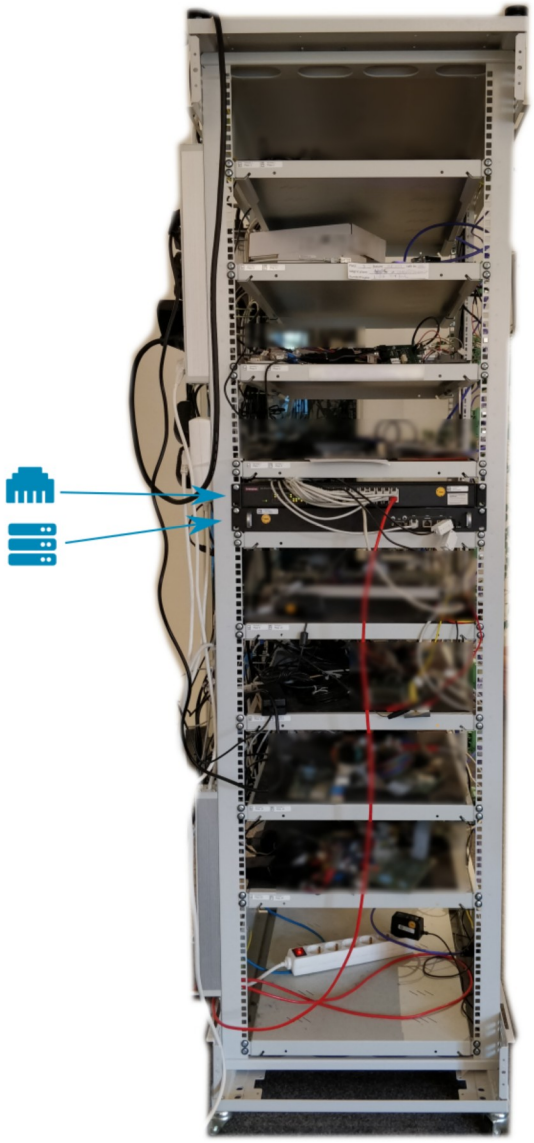
- GPIO

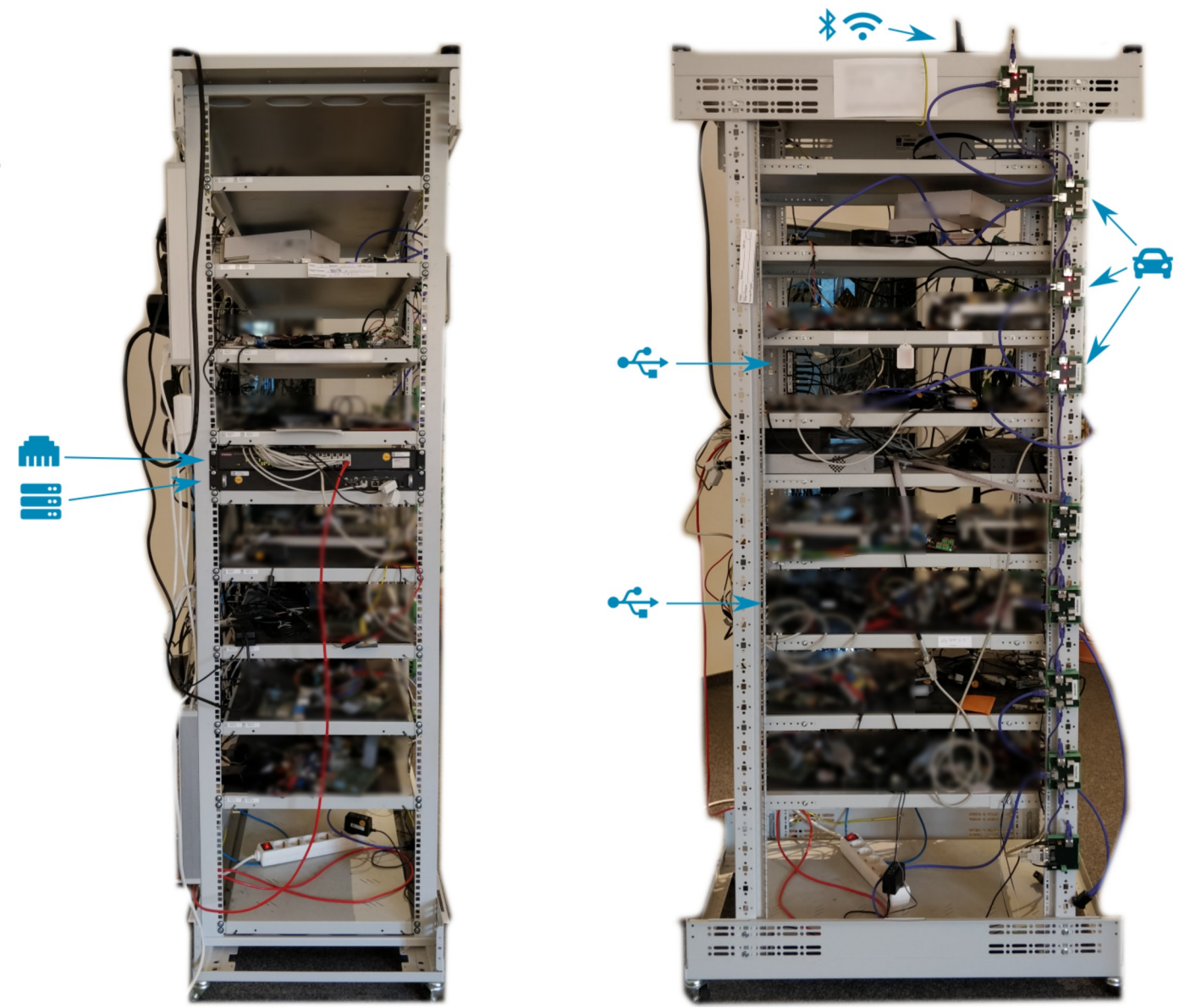
Test-Server

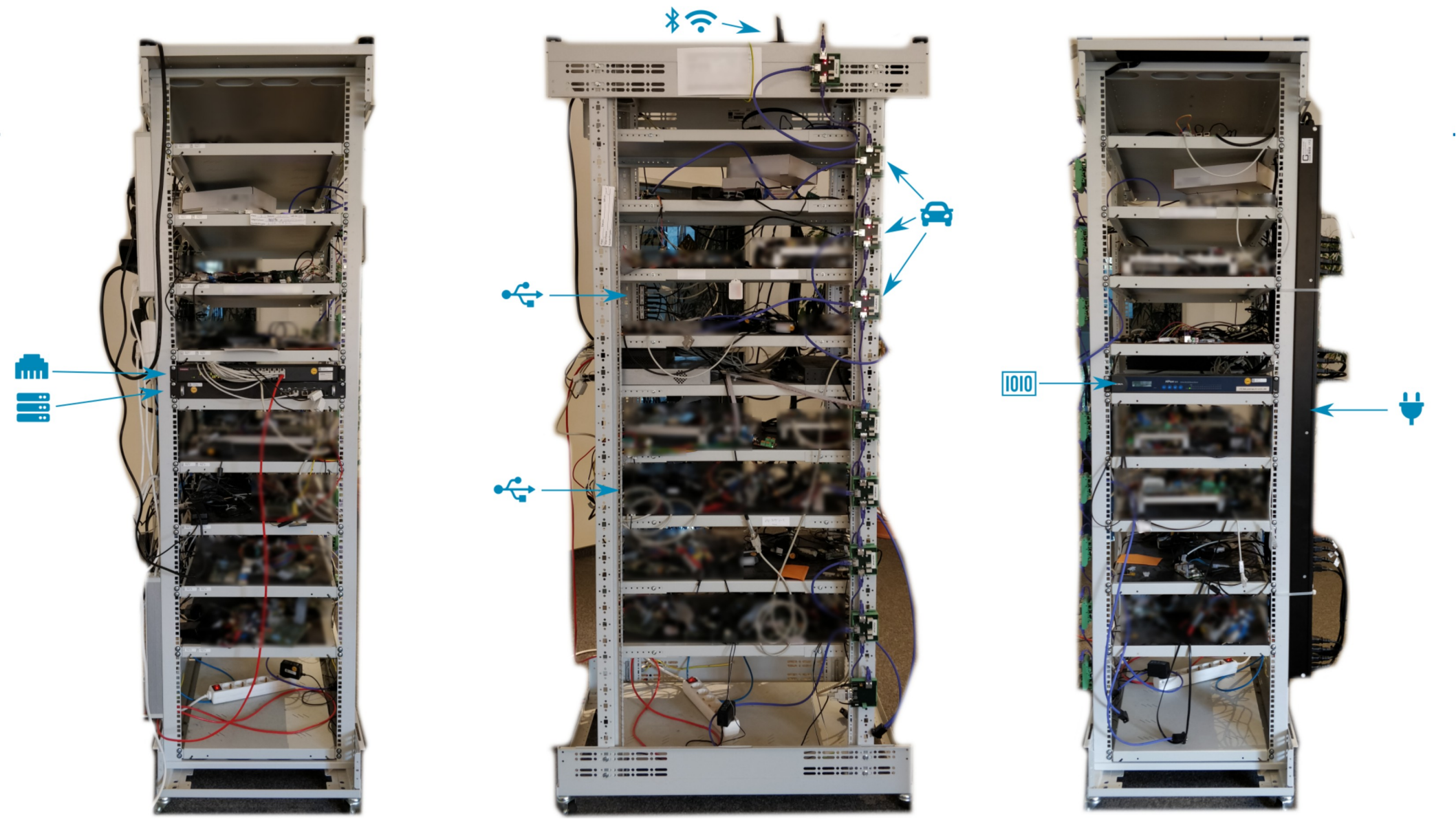
- CAN
- USB
- 1-Wire via USB



Lab: Rack



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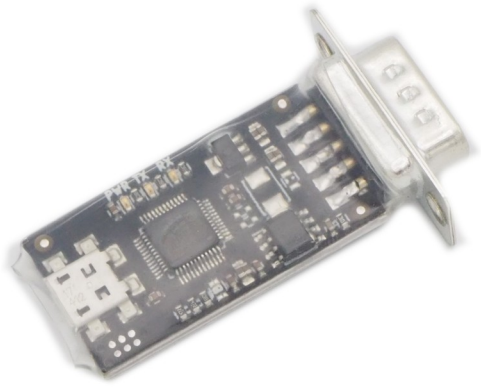
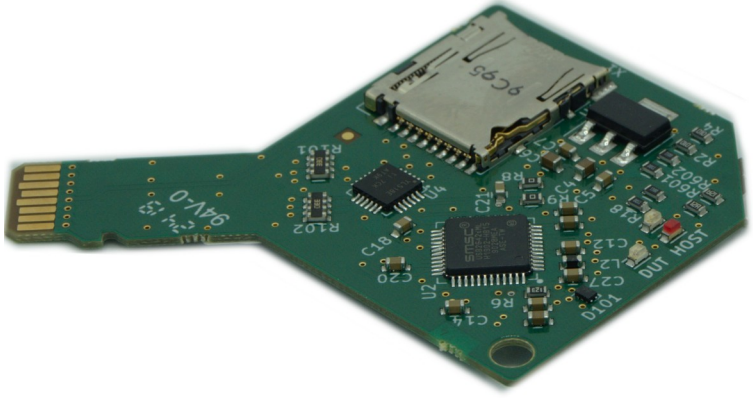
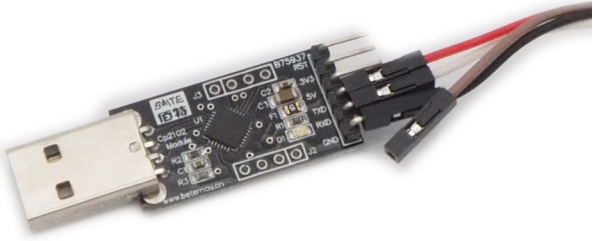
Problems: USB







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- Misbehaving DUTs

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- Misbehaving DUTs
- Misbehaving Hubs and other devices
- Never enough USB Addresses on a bus

Problems: EMC

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- Multiple GND-Loops
  - Resistive: USB, Ethernet (if shielded), Serial (if external Device), 1-Wire, CAN, RS485 between multiple devices, …
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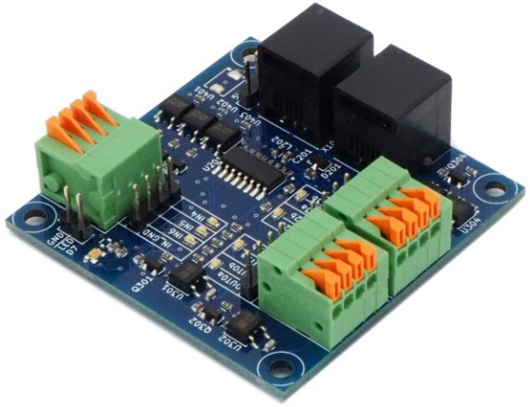
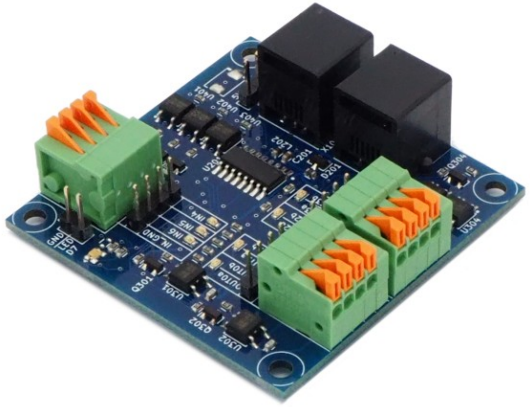
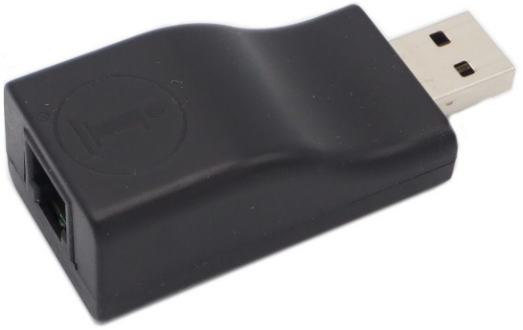
- Prototype-Hardware: Mostly not EMC-tested

Problems: 1-Wire



Problems: 1-Wire





Use Cases

Interactive:

- Log in
- Direct interaction with device:
  - Measurements
  - Observe Displays

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Remote / automated use:

- Interactive Login
- Measure signals
- (Automated) running of test suites

Future of Automated Testing at PTX?

- More continuous testing in customer projects
- More interactive work from „remote“

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- More continuous testing in customer projects
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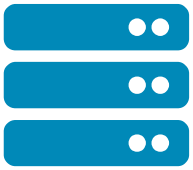
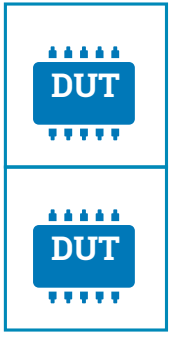
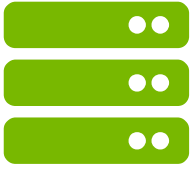
- Need to increase reliability

Use multiple test controller per lab



Test-
Server





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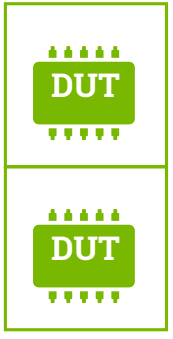

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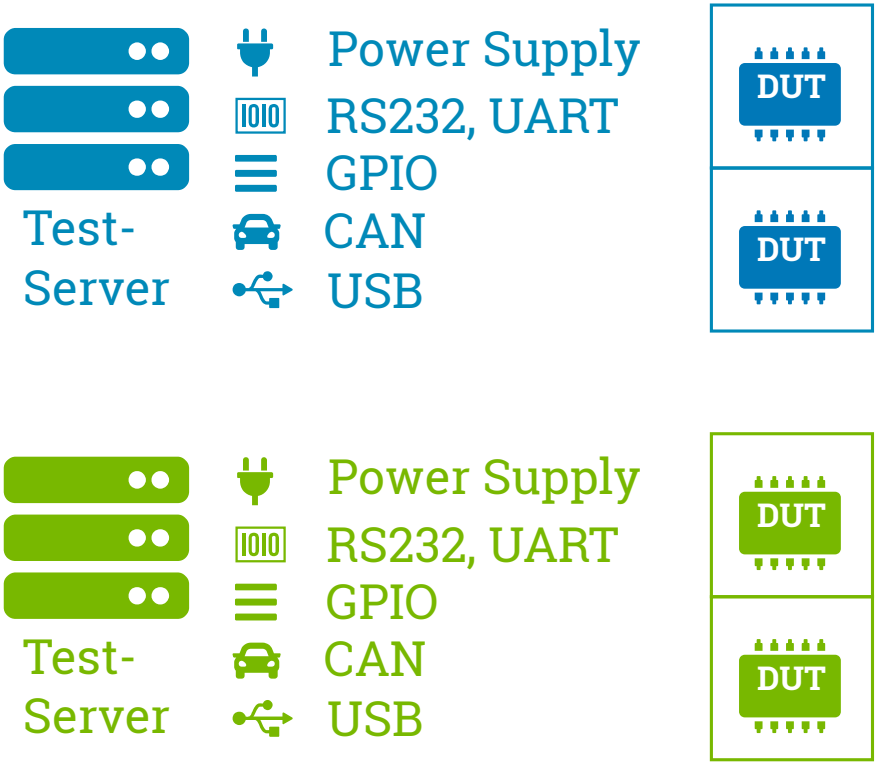

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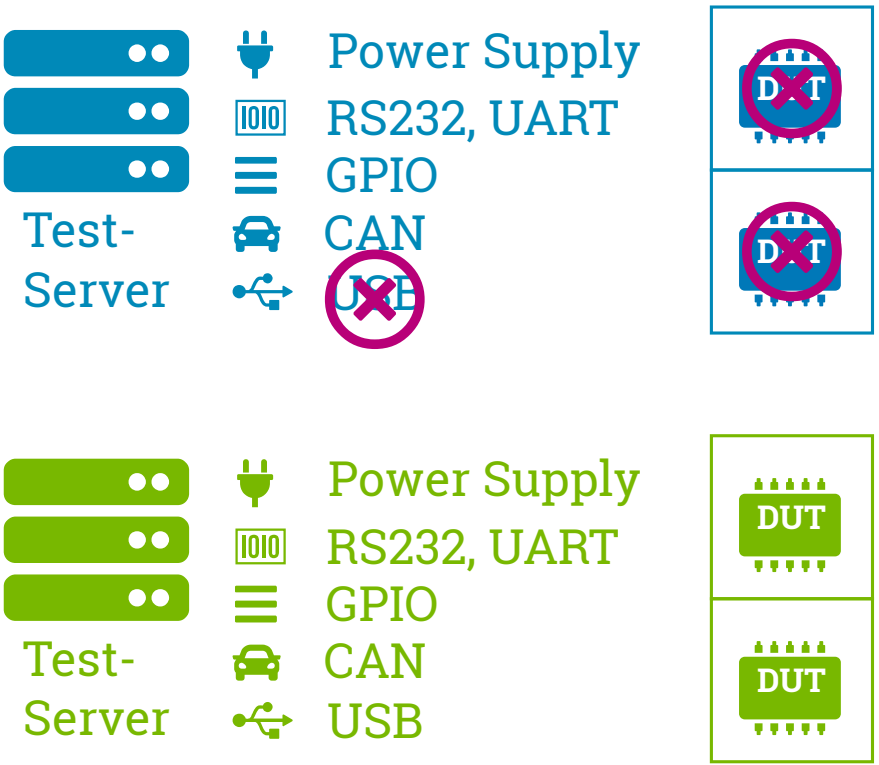

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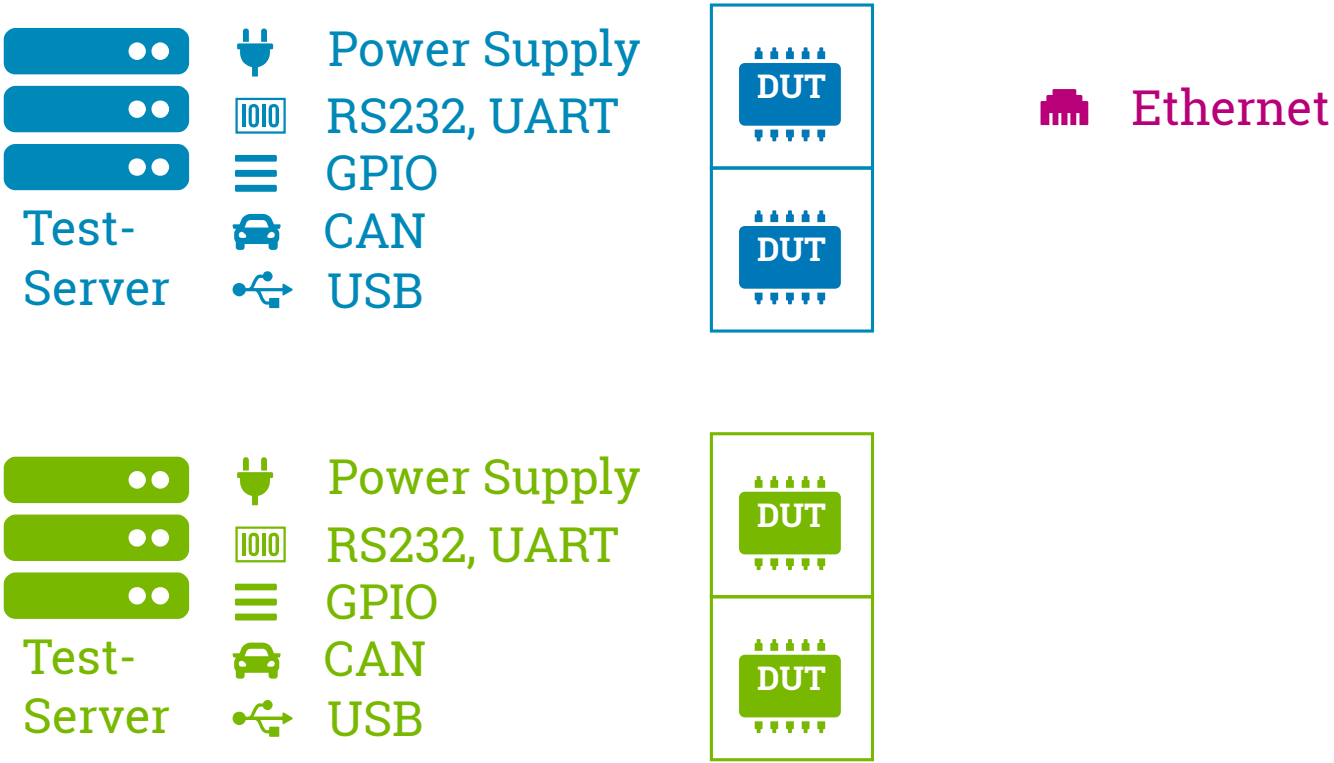

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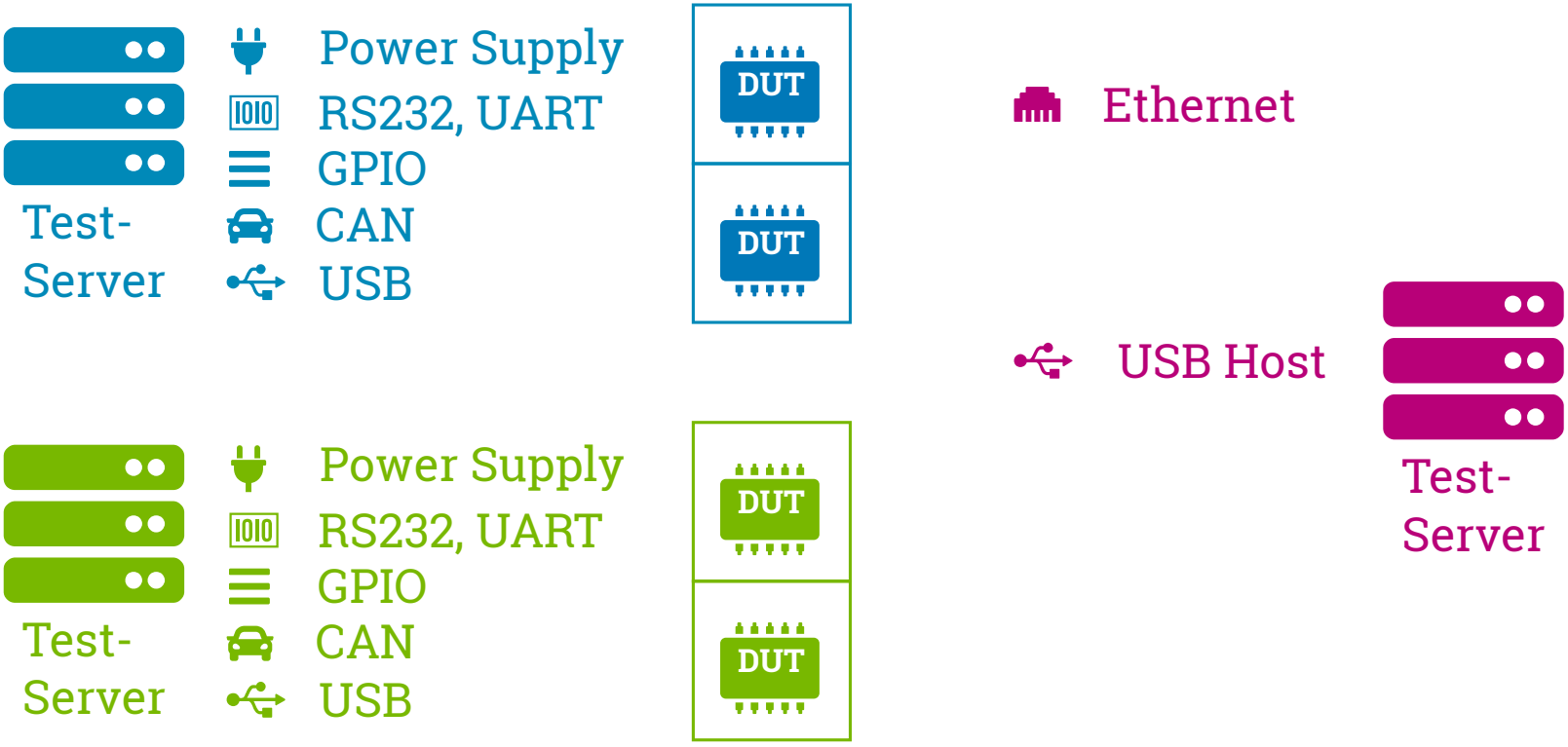

CAN-Bus

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- Common pin assignment, connector with supply
- Allows us to use a galvanic isolation between the bus and a DUT
- Adds complexity to the nodes:
  - Microcontroller needed
  - Protocoll on top of CAN: e.g. CANOpen

Power Supply Switches

- Add switches on SELV-side of PSUs
- Control of inrush-currents
- Measurement of current and voltage

Recap

- More continous testing in customer projects
- More DUTs in our lab

- Low reliability is causing dissatisfaction and costs money

- => Split out labs into smaller error domains
- Replace USB where ever possible

Questions / Discussion

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Discussion: Feature Whishlist for TAC

Discussion: Is USB in a Lab possible?

Discussion: Lab segmentation?